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EXAMINER	
VAN DOREN, BETH	
ART UNIT	**PAPER NUMBER**
3623	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/491,461	Applicant(s) DAGUM ET AL.	
	Examiner Beth Van Doren	Art Unit 3623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 28 April 2006.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The following is a Final Office action in response to communications received 04/28/2006. Claims 1, 12, and 21 have been amended. Claims 1-21 are pending in this application.

Response to Arguments

2. Applicant's arguments with regards to Hillier et al. (Introduction to Operations Research) have been fully considered, but they are not persuasive. In the remarks, applicant argues that Hillier et al. does not teach or suggest (1) examining elemental blocks to determine if a first element has not been loaded with a corresponding first resource that gates production of the first element and so that blocks may be reloaded, (2) conditional reloading of elements based on an examination of the elemental blocks, (3) decomposing the multivariable problem into several single variable problems, and that (4) modifying Hillier et al. to include the inverse Cholesky transformation or to incorporate the elliptical family of distributions is not obvious merely because the functions are well known, and (5) a reference supporting that it would be obvious to use an inverse Cholesky transformation in conjunction with the other limitations of claims 11 and 15.

In response to argument (1), Examiner notes that these limitations have been added in the current amendment and is addressed below, in the updated art rejections necessitated by amendment.

In response to argument (2), Examiner respectfully disagrees. The loading, unloading, and reloading recited in the claims is viewed by the examiner as the iterations involved when solving a non-linear optimization problem. Utilizing the constraints, iterations of different

values replacing the variables are performed. See pages 564-5, wherein a single variable is used and the equation is loaded and reloaded with values that control production. The equation is solved with each iteration to determine the outputs. Each output is analyzed to see if a potentially better (more optimal) solution exists by checking solutions adjacent to the current.

In response to argument (3), examiner respectfully disagrees. First, Examiner points out that claims 1, 12, and 21 recite that the invention is an automated method for "optimizing a multivariate representation of resources", "optimizing a multivariate non-linear expected value function", and "optimizing the multivariate amount of refinements", respectively. Examiner points out that multivariate, by well-known definition, means having or involving more than one variable. The independent claims recite language such as "as a function of a single variable", "solving for the maximum of each elemental block over each associated single variable", "elemental blocks as a function of a single variable of the multivariate non-linear expected value function", and "each of the elements is described by a single variable of the closed form expression". Therefore, the claim language does not specifically limit the claims to single variable analysis, but rather multivariable analysis (wherein each single variable is explored and provides input to the overall problem). First, both the loading and re-loading steps recite "as a function of a single variable", thus stating that each step involves a different and separate variable (i.e. two variables). The use of at least two variables is further supported by the language of the solving step, which states solving each block over each single variable (i.e. each requires more than one). Therefore, it is unclear as to why the Applicant has reiterated with argument concerning a multivariable problem with multivariable techniques, specifically in light of the amendments.

Further, even if the claims did involve a single variable problem, Examiner points out that page 563 of Hillier et al. specifically recites "When a non-linear programming problem has just one or two variables, it can be represented graphically much like the Wyndor Glass Co. example" and "to highlight the differences between linear and non-linear programming, we shall use some nonlinear variations of the Wyndor Glass Co. Problem".

In response to arguments (4) and (5), Examiner respectfully disagrees. With regards to the Cholesky transformation, Examiner points out that the claims merely recite "the transformation includes an inverse Cholesky transformation" without states how the inverse Cholesky is specifically relied upon to transform such a space. Therefore, since it was well known to use an inverse Cholesky transformation to transform values and variables in the art of matrix algebra and mathematics and since one would use matrix manipulation as well to solve the independent claims (using matrices to manipulate linear and non-linear programming problems is well known in the art), it would have been obvious to one of ordinary skill in the art at the time of the invention to use an inverse Cholesky transformation (also known as an inverse symmetric square root) in the working transformed space of Hillier et al. in order to increase the efficiency of manipulating and solving the equations of Hillier et al. By more efficiently solving the equations, run time will be reduced thereby saving costs. Examiner cites "Inversion of Large, Symmetric, Positive Definite, Non Sparse Matrices" by IBM, dated 03/1980, which discuss the use of the inverse Cholesky factor.

As for the elliptical family of distributions, Examiner points out that the elliptical family of distributions includes normal distributions and multinormal distributions, both of which are readily used in all sorts of operations research, scheduling, and financial applications. The

normal distribution, specifically, is used to model many numerical populations and is used in many mathematical studies. Therefore, examiner reasserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to include the elliptical family (specifically normal distributions) in the distributions of Hillier et al. in order to increase the ability of the tool to meet the needs of the user by adding mathematical features and techniques that are readily used in the word of mathematics.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-10, 12, and 16-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Hillier et al. (*Introduction to Operations Research*).

As per claim 1, Hillier et al. teaches a computer implemented method comprising:

optimizing a multivariate representation of resources, wherein the resources are used in producing a set of products, and the resources, the set of products, and their respective connectivities being represented in a product space plan (See pages 26-28, and 559, wherein a plan is formed associated with a non-linear Expected Value Function (EVF) for optimizing a model that is associated with resources (time and machines, for example) and products (products 1 and 2, for example), the model containing multiple decision variables that are interrelated and manipulated to determine an optimal solution), the optimizing comprising:

converting a non-linear expected value function associated with the resources and products into a closed form expression (See pages 26-27, which sets up the problem. See pages 559 and 564-5, which discloses a non-linear expected value function that is converted to be solved);

transforming the product space plan into a working transformed space plan, wherein the products are transformed into working elements (See pages 559 and 564-5, which transforms the plan in a working plan, wherein the products become working elements of the objective functions);

performing a load step to form elemental blocks as a function of a single variable of the multivariate representation with elements being loaded with resources that gate production of the elements (See pages 564-5, wherein a single variable is used and the equation is loaded with a value that controls production. The equation is solved);

examining the elemental blocks to determine if a first element has not been loaded with a corresponding first resource that gates production of the first element (See page 83-85, wherein each block is checked to see is a first resource solution has been loaded into the block. See also pages 564-5, wherein a single variable is used);

if the examining indicates that the first element has not been loaded with the first resource, performing a re-loading step to form elemental blocks as a function of a single variable of the multivariate representation with the first element being reloaded with the first resource (See pages 41-43, which discusses additively assumptions. See also pages 564-5, wherein a single variable is used and the equation is loaded with another value that controls production. The equation is again solved);

solving for the maximum of each elemental block over each associated single variable of the multivariate representation, wherein solving is performed by a computer (See pages 564-5 and 606-7, wherein local and global maximums are solved and wherein a computer is used to perform the solving. See also 568-9, which discusses unconstrained optimization); and

determining the optimum level of resources as a function of the solved for maximums (See pages 564-5, wherein the optimal level is determined. See also 568-9, which discusses unconstrained optimization).

As per claim 2, Hillier et al. discloses wherein the loading and re-loading steps result in an equilibrium configuration that provides the minimum amount of resources to produce any given amount of products across the whole plan (See pages 564-5, wherein the optimal level is determined. See also 568-9, which discusses unconstrained optimization).

As per claim 3, Hillier et al. teaches wherein the loading step further includes:

sequentially looking at each present work element (See pages 564-5, 569, 571, and 577, wherein each work element is considered);

determining if each associated resource gates production of the element (See pages 565, 569, 571, and 577, wherein a determination is made as to if a resource controls the element);

if gating occurs, then unloading the resource from a prior element if so loaded, and loading the resource onto the present element (See pages 565, 569, 571, and 577, wherein if the controlling is not considered positive, a new value is loaded).

As per claim 4, Hillier et al. teaches wherein the reloading step further includes:

sequentially looking at each present work element (See pages 564-5, 569, 571, and 577, wherein each work element is considered);

reloading each unloaded resource back onto the element (See pages 565, 569, 571, and 577, wherein the elements are reloaded);

redetermining if the element is gated by each reloaded resource (See pages 565, 569, 571, and 577, wherein a determination is made as to if a resource controls the element);

if the element is so gated, then merging the elements sharing each gating resource into a common elemental block which is a function of a single variable (See pages 565, 569, 571, and 577, which discloses the graphing and merging of elements).

As per claim 5, Hillier et al. teaches wherein step of determining that gating occurs includes calculating a new maximum for the loaded element and determining if any remaining components further gate the maximum (See pages 564-5, which discloses loading elements and determining local and global maximums. These maximums are controlled by inputs. See also 568-9, which discusses unconstrained optimization).

As per claim 6, Hillier et al. teaches wherein the step of redetermining that gating occurs includes recalculating a new maximum for the reloaded element and determining if any remaining components further gate the maximum (See pages 564-5, which discloses loading elements and determining local and global maximums. These maximums are controlled by inputs. See also 568-9, which discusses unconstrained optimization).

As per claim 7, Hillier et al. discloses wherein the step of merging the elements results in an elemental block that is a sub-plan of the overall plan, but which is a function of a single variable (See pages 563-5, 569, and 571, which discloses merging elements that are a function of a single variable).

As per claim 8, Hillier et al. discloses wherein the merged elements intersect at a common resource in the transformed spaces (See pages 563-4, wherein the elements intersect).

As per claim 9, Hillier et al. discloses wherein the expected value function represents a statistical expectation of the value function at a given resource allocation and for a given demand distribution (See at least pages 559 and 564-5, which discloses a non-linear expected value function, wherein the function represents the expectation of a value).

As per claim 10, Hillier et al. teaches wherein the transforming step involves taking a transformation of the product space to provide the working transformed space wherein the distribution induced on the resources is transformed into a distribution with zero mean and unit variance (See pages 577-578, which discusses unconstrained optimization where the trial solution is varied by unit until the derivative is essentially zero).

As per claim 12, Hillier et al. teaches a computer-implemented method comprising:

optimizing a multivariate non-linear expected value function, wherein the multivariate non-linear expected value function represents a statistical expectation of the non-linear expected value function at a given component allocation and for a given demand distribution (See pages 26-28, and 559, wherein a plan is formed associated with a non-linear Expected Value Function (EVF) for optimizing a model that is associated with resources (time and machines, for example) and refinements (products 1 and 2, for example), the model containing multiple decision variables that are interrelated and manipulated to determine an optimal solution that represents an allocation of resources that meets the demands of the problem), the optimizing comprising:

forming a plan in the product space associated with the non-linear expected value function which represents products, components, and connectivities therebetween (See pages 9-11, 13, 26-28, and 559, wherein a plan is formed associated with a non-linear EVF);

transforming the product space plan to form a corresponding working space plan, with products corresponding to elements such that the distribution induced on the resources is transformed into a distribution with zero mean and unit variance (See pages 559 and 564-5, which transforms the plan in a working plan, wherein the products become working elements of the objective functions. See pages 577-578, which discusses unconstrained optimization where the trial solution is varied by unit until the derivative is essentially zero);

converting the associated expected value function into a closed form expression (See pages 559 and 564-5, which discloses a non-linear expected value function that is converted to be solved);

performing a load step which loads each element with components that gate production of the element, wherein the loading step forms elemental blocks as a function of a single variable of the multivariate non-linear expected value function (See pages 564-5, wherein a single variable is used and the equation is loaded with a value that controls production. The equation is solved);

examining the elemental blocks to determine if a first element has not been loaded with a corresponding first resource that gates production of the first element (See page 83-85, wherein each block is checked to see is a first resource solution has been loaded into the block. See also pages 564-5, wherein a single variable is used);

if the examining indicates that the first element has not been loaded with the first resource, performing a re-loading step to form elemental blocks as a function of a single variable of the multivariate representation with the first element being reloaded with the first resource (See pages 41-43, which discusses additively assumptions. See also pages 564-5, wherein a single variable is used and the equation is loaded with another value that controls production. The equation is again solved);

wherein the reloading step forms elemental blocks as a function of a single variable of the multivariate non-linear expected value function (See pages 564-5, wherein a single variable is used and the equation is loaded with another value that controls production. The equation is again solved);

merging elements that are further gated by components that were unloaded, with the loading, reloading, and merging steps resulting in an equilibrium configuration (See pages 564-5, wherein elements are merged and global maximums are solved. See also 568-9, which discusses unconstrained optimization); and

solving the equilibrium configuration to determine the optimization of the expected value function, wherein the solving is performed by a computer (See pages 564-5, wherein the optimal level is determined. See also 568-9, which discusses unconstrained optimization. See 606-7, which discusses software packages to solve the problem).

Claims 16-17 recite equivalent limitations to claims 3-4 and are therefore rejected using the same art and rational applied above.

As per claim 18, Hillier et al. teaches the equilibrium configuration includes configuring of the plan into elemental blocks which are a function of a single variable (See pages 564-5, 569, 574-5, wherein the plan includes elemental blocks that are a function of a single variable).

As per claim 19, Hillier et al. teaches wherein the elemental block is maximized over this single variable (See pages 564-5, 569, 574-5, wherein the elemental block is maximized over a single variable).

As per claim 20, Hillier et al. discloses wherein the optimum level of components to support the maximization are derived from the maximized elemental values (See pages 564-5 and 568-9, wherein the optimums are derived).

As per claim 21, Hillier et al. teaches a computer-implemented method comprising:

optimizing a multivariate representation of an amount of refinements produced from a level of resources (See pages 26-28, and 559, wherein a plan is formed associated with a non-linear Expected Value Function (EVF) for optimizing a model that is associated with resources (time and machines, for example) and refinements (products 1 and 2, for example), the model containing multiple decision variables that are interrelated and manipulated to determine an optimal solution that represents the number of refinements produced to maximize total profits), the optimizing comprising:

configuring the refinements and resources in a representative refinement space plan that accounts for connectivities therebetween (See pages 9-11, 13, 26-28, and 559, wherein a plan is formed associated with a non-linear EVF);

deriving a non-linear expected value function for the refinement space plan (See pages 559, 564-5, and 577-578, wherein a non-linear EVF is derived to model the plan);

converting the non-linear expected value function to a closed form expression (See pages 559 and 564-5, which discloses a non-linear expected value function that is converted to be solved);

transforming the refinement space plan into a working space plan, with the refinements represented by transformed elements (See pages 9-11, 13, 559, and 564-5, wherein the plan is transformed into a working model with the refinements represented in the elements);

sequentially loading each element with resources that gate production of the element, wherein the each element is described by a single variable of the closed form expression (See pages 564-5, wherein a single variable is used and the equation is loaded with a value that controls production. The equation is solved);

sequentially examining the elemental blocks to determine if a first element has not been loaded with a corresponding first resource that gates production of the first element (See page 83-85, wherein each block is checked to see is a first resource solution has been loaded into the block. See also pages 564-5, wherein a single variable is used);

if the examining indicates that the first element has not been loaded with the first resource, performing a re-loading step to form elemental blocks as a function of a single variable of the multivariate representation with the first element being reloaded with the first resource (See pages 41-43, which discusses additively assumptions. See also pages 564-5, wherein a single variable is used and the equation is loaded with another value that controls production. The equation is again solved);

merging elements that are further gated by components that were unloaded, with the loading, reloading, and merging steps resulting in an equilibrium configuration (See pages 564-5, wherein elements are merged and graphically depicted. See also 568-9); and

solving the equilibrium configuration to determine the optimization of the expected value function, wherein the solving is performed by a computer (See pages 564-5, wherein the optimal level is determined. See also 568-9, which discusses unconstrained optimization. See 606-7, which discusses software packages to solve the problem).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 11 and 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hillier et al. (*Introduction to Operations Research*).

As per claim 11, Hillier et al. discloses wherein the transforming step includes transforming and manipulating the function (See pages 559 and 564-5, which transforms the plan in a working plan, wherein the products become working elements of the objective functions). However, Hillier et al. does not expressly disclose using an inverse Cholesky transformation.

Hillier et al. discusses manipulating and solving the mathematical expressions representing resource allocation problems. Using an inverse Cholesky transformation to transform values and variables is well known in the art of matrix algebra and mathematics. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the

invention to use an inverse Cholesky transformation in the working transformed space of Hillier et al. in order to increase the efficiency of manipulating and solving the equations of Hillier et al. By more efficiently solving the equations, run time will be reduced thereby saving costs.

As per claims 13 and 14, Hillier et al. teaches a demand distribution including any multivariate demand distribution that is non-linear (See pages 559, 563-6, 570-1, which discloses non-linear demand distributions with non-linear objective functions). However, Hillier et al. does not expressly disclose the elliptical family of distributions or normal distributions.

Hillier et al. discusses manipulating and solving the mathematical expressions representing non-linear resource allocation problems. The elliptical family of distributions is well known in the art of mathematics and in non-linear distributions. Further, normal distributions are well known in the art of mathematics. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include the elliptical family and normal distributions in the distributions of Hillier et al. in order to increase the ability of the tool to meet the needs of the user by adding mathematical features and techniques that are readily used in the word of mathematics.

Claim 15 recites equivalent limitations to claim 11 and is therefore rejected using the same art and rationale as set forth above.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Jameson (U.S. 6,965,867) teaches allocation of resources using matrices and loading values into the matrices.

Jameson (U.S. 6,032,123) discloses allocation of resources using matrices and loading values into the matrices.

Deizel et al. (U.S. 5,406,476) teaches constrained allocation of resources using matrices and normal distributions.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Beth Van Doren whose telephone number is (571) 272-6737. The examiner can normally be reached on M-F, 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tariq Hafiz can be reached on (571) 272-6729. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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June 27, 2006

Romain Jeanty
Primary Examiner
Art Unit 3623